Secondary Education Ecology Module on the Near Shore Marine Environment

Robert Bruck

University of Hawai'i

bbruck@hawaii.edu

Abstract. Ecology is an increasingly important component in the marine science field of education. The Islands of Hawaii host a very fragile marine ecosystem that is under constant threat from anthropogenic interaction and natural events. Including ecology education in the marine science class to students in Hawaii's secondary education system may be a logical approach to addressing these issues. Because of limited classroom time and resources, ecology is often not included in the curriculum. By integrating educational technologies, science teachers may be able to provide an ecology program of study to their students. This could reach both inside of the traditional classroom and, to a wider range, outside in the form of self study and homework. This research evaluated the effectiveness of online tools to teach an ecology class. Web based ecology material was provided to the participants for reference. Instruction for designing a slide sharing program in the online program Slideboom was also supplied. The participating science teachers were tasked to develop an online slide share program that included images, text and audio and share it with their students. They were then to observe and evaluate the impact of this instruction on their students. At question was, would the participating science teachers be able to employ educational technologies and realize the benefit of supplementing the traditional hands on lab with instruction and expectations using these technology tools in their particular classes? Attitudinal survey questions provided feedback on the effectiveness of this venue from the perspective of the participants. Results of the study indicated that a substantial majority of the participants realized beneficial results with the educational technology tools in the science classroom. In addition, some participants also sought information and access to peripheral educational technology tools used in the study.

Introduction and Background

According to Tissot (2006) of the Hawaii Coral Reef Network, the environmental degradation of the shoreline on the Island of Maui is starting to impact a wide range of interests. Finding any educational information on the near shore waters of Maui is difficult for anyone, even the residents of Maui. Only now, is the community beginning to realize the economic value of the shoreline environment. Not only are the fisheries dependent on the near shore environment, the entire visitor industry depends on this critical zone as well. Therein lies the dilemma, with an increasing resident population and a large influx of visitors, the inadvertent damage to the near shore reefs is substantial. The area is being loved to death by visitors and residents by a lack of education (Davidson, Hamnet & Minato). Estimates on restoration costs run from $550 to $10,000 an acre to restore a near shore reef back to almost pristine quality according to Precht (2006). This, however, does not address the root cause of the degradation

Imagine being one of the two million visitors arriving on Maui or planning a trip to the Island. A great deal of information can be found on the many Maui Visitors web sites pertaining to island activities. However, information on that same marine ecology that the visitors have come to see is noticeably lacking. The average Maui visitor typically visits three different ocean sites during their 8.9 day stay on Island (Maui DBEDT). This compares with the average resident who will access the ocean either to snorkel or dive 26 days at ten different sites per year. Estimating each foray into the ocean covering 200 square meters, this alone would ensure that annually, every meter of Maui's shoreline would receive human interaction many times over. This in itself is a staggering picture, but, the reality is that most interaction occurs in a few select spots that sport conditions most favorable to human activity. By not understanding the impact of their actions, visitors inadvertently interact with the near shore environment in a destructive manner. Unintended activities such as touching and trampling on marine flora and fauna and littering effectively destroy that of which they seek.

In any endeavor involving change, perspectives must be changed from the highest positions of government and industry as well as the ordinary citizenry. Educators and policy makers alike perceive technology as the catalyst of academic reform. The National Science Teachers Association (NSTA) has called for educators to develop and implement science curricula that integrate appropriate technology and make science learning more efficient and effective through computers. In addition, the NSTA (1999) has further contended that science education should include the computer as a key contributor. With technology, the emphasis changes from teacher centered instruction to student centered construction according to Dexter, Anderson and Becker (1999). The constructivist approach to educational technology is a crucial factor in its implementation and effectiveness. In fact, many studies of technology tools in the classroom provide a positive link between these tools and subject mastery. Clarke, Flaherty and Mottner (2001) report the relationship between 14 educational technology tools and three outcome variables as perceived by the students surveyed. The educational technology tools included familiar venues such as electronic discussion groups, online readings and web page projects. Results indicated 9 of the tools significantly influenced the surveyed students overall learning,

Ten of the fourteen tools were perceived by the students as influential in the actual ability to get a job, and 8 were believed to influence expected job performance. Of utmost importance here is the expectations and perception of the students to educational technologies.

Of interest to this study, is the educational impact of online slide sharing software. From the earliest days of image display, video and audio capture, these combined resources have been an effective tool in the educational environment. Teachers have long realized the benefit of augmenting a lesson with some form of technology. Studies on the effectiveness of various forms of educational multimedia (Tabbers, Martens and Van Merrienboer, 2004) indicated that incorporating visual instructional tools was far more effective in student learning capacity than strictly audio instruction. When the subjects of the study were directed to web based lesson plans, participants utilizing the audio only tutorial showed significantly lower transfer and retention scores than those having access to both visual and audio instruction.

While educational technology is generally heralded as a positive step in education, caution should be observed when incorporating it into the classroom, as, not all students are able to take advantage of it on an equal basis. Krentler and Willis-Flurry (2005) indicate that individuals that may be from underprivileged backgrounds or immigrants dealing with second language issues may have a more difficult time in adjusting to educational technology. Hawaii is host to a very large mixture of nationalities and cultures necessitating consideration of such aspects. Personal aptitude is another factor that absolutely must be considered. Seldom are two identical students encountered in the learning environment.

Instructional Activities

By providing a readily available and accessible form of education through Web 2.0 technology, destructive anthropogenic interaction may be eliminated or minimized. The possible solution to this growing problem is to involve some of Maui's secondary public school system in the education of marine ecology. Marine science classes from on-island high schools have in recent years been active in community projects around the Island aimed at restoring and protecting the marine environment. By providing further education and tools to the staff at these high schools, this effort can be enhanced. The possible solution forward is to design an educational module on marine ecology to implement in the science classes. Studies indicate (Dexter & Becker, 1999) that teachers perceive technology as a catalyst for change in the classroom. For this instructional design module, the participating teachers accessed a Web based instructional module on building a marine ecology lesson using educational technology in the form of the Slideboom online slide sharing program. An instructional slide sharing module was developed for posting on the Web. Background material for the lesson plan utilized an array of web based educational resources on marine ecology. The effectiveness of the module was evaluated in a post module survey. The results of this research will serve as an indication on the effectiveness of technology tools in the science classroom and specifically, online slide sharing technology tools.

Slideboom is a slide sharing program that streamlines PowerPoint sharing and is accessible to a wide range of platforms and is free of charge. This form of cyber access for PowerPoint presentations includes animations, transitions, audio, video and flash It is a product that is similar to Slideshare, Sliderocket and Smilebox and it is "yet another amazing free utility on the web" (Oro, 2009).. Most of the advanced features of PowerPoint are supported and the final product on SlideBoom will look exactly the same as in the source PowerPoint. Transition of fonts, sounds or animations is seamless Another positive aspect of SlideBoom is a free PowerPoint add-in that allows the user to upload presentations with audio, video and Flash quickly and easily directly from PowerPoint It was chosen based upon its availability, platform range and its relative simplicity in learning and usage. Once images, video clips or audio files are uploaded to Slideboom, unlimited access is available from any platform eliminating the fear of error and easing technology anxiety. Laptop computers and portable storage devices are not needed to access the presentation slides. The end product can then be posted on a personal website, social media sites or off-line resources.

Posting the instructional module and end product on the web was also a choice based upon access. Once the product was finished, a web posting allowed the science teachers and students access to it. But, beyond that, because of its capacity to reach across oceans, divides and borders, the Web is the right tool to reach residents and visitors on the island and potential visitors researching a vacation destination. As the Web continues to transition as the source of favored media globally, the ability to reach an increasingly aware population can not be overlooked

Study Participants.

It must be stipulated that the actual participants of this study were not students. They were, instead secondary education teachers from two high schools on the Island of Maui. The teachers were all science instructors teaching marine science and biology. Participation did not include race, religion or gender as prerequisites. Participants were between the ages of 25 to 62, with this criteria being only a factor based upon the age range of teachers at the two high school campuses. Subjects were college educated possessing a minimum educational level of a bacholaureate degree from an accredited institution. This, again, was a conditional requirement for the science department teaching position at the two schools.

Evaluation, Research Methods and Outcomes

Evaluation for this instructional design was via the means of review by subject matter experts (SME). Upon completion the module was passed on to a marine ecology expert at the University of Hawaii Hilo. Also reviewing the module was the primary marine science teacher at Baldwin High School. After feedback is received from the SME's, the module was modified accordingly.

Data Analysis was based upon pre-module and post-module feedback from the high school science teachers, who, received and participated in the instructional design module. The evaluation was based upon a series of ten attitudinal survey questions posed to the teachers. The format was a multi-choice Likert scale embedded in another technology tool named Surveymonkey. The responses were uniform on all survey questions with the option to; strongly

disagree, disagree, be undecided, agree or strongly agree. Participant privacy was assured. The teachers were encouraged to email responses and comments or simply respond to the survey electronically in the provided software program

The instructional design model was based on a proven blueprint and process that includes five phases, Analysis, Design, Development, Implementation and Evaluation (ADDIE), According to a popular online encyclopedia (Wikipedia, 2010), ADDIE is a process utilized for instructional design and training development that allows for formative feedback in the instructional design course of action. ADDIE was deemed ideal and chosen for its emphasis on analysis. The timeline followed the ADDIE model allowing for evaluation after every step. The analysis portion began on November 1st 2009. The instructional design also included Gagne's Nine Events of Instruction in order to establish a learner centric instructional base. In utilizing this formula for the instructional design, the lesson was reasonably well structured and comprehensive. The design allowed the learner the ability to implement the lesson plan for the instructional module and also apply the knowledge to other future applications.

Results

Each participant built a marine ecology module that applied to their individual curricula. In one example where the students were studying botany and phycology, the participant built a lesson on invasive marine algae in Hawaii. Another participant was able to incorporate a marine ecology lesson plan on beach and dune processes. The participants demonstrated unexpected flexibility in incorporating the marine ecology module in their respective curriculums. The study participants also had to endure a last minute change in a technology tool, which is discussed in greater detail later. Despite this, the integrity of the study time frame remained intact Five out of eight targeted science teachers participated in the study, with all completing the post study survey in a timely fashion

When asked if the goal of the instruction was clear and understandable, all participants responded favorably. Three of the participants agreed and two indicated strong agreement. Two factors exist that contribute to the participants understanding the goal of the study. First, all participants were approached directly by the researcher and the study was explained to them directly before agreeing to participate. Secondly, the study was outlined on the homepage of the website that the participants had to access in order to develop their module and participate in the survey. Another contributing factor could be the additional personal interaction created by the change in technology tools.

A second survey inquiry delved into whether the lesson plan was understandable and easy to follow. All participants indicated agreement with one indicating strong agreement. Again, the lesson plan was both discussed with each individual and submitted electronically via the website to each. With the smaller field of participants it was almost expected that even with ambiguous issues, frequent communications between the researcher and subjects was both expected and solicited by the participants.

When queried if sufficient instructional material was provided for this lesson, all but one participant were in agreement. The lone participant indicated undecided in this area. Several possibilities were offered as explanation by participants. The first and most feasible scenario was based on provided reference material being insufficient for the curriculum requirements of the participant. It must again be noted that each participant was involved in separate areas of science study when the module was implemented. Other explanations for the undecided response included the lack of complexity and detail in the reference material itself or possibly non peer review material being utilized.

An undecided was also lodged when polled if the instructional material was presented in an interesting and captivating manner. A respondent indicated that a more visually captivating website may have made the subject material more captivating. The material presentation was deliberately designed to be simple and comprehensive. No strongly agreed response was recorded, lending some credence to the single undecided voter.

Three disagrees were polled when asked if the media used for the lesson plan was easily accessible. An explanation was provided immediately upon implementation of the module. The technology tools used in the study were not approved for use in the classroom by the Hawaii State Department of Education (DOE). This was an oversight on the part of the researcher who did not delve into this particular aspect. Participants were able to proceed with the module as a homework assignment.

When solicited on whether the lesson plan was a valuable addition to the participant's class, DOE regulation again factored with the respondents clearly indicating that they could only use this as a homework assignment. One respondent who agreed that the lesson plan was a valuable addition saw the value in it as a homework venue. Consensus indicated all participants would have responded more favorably had the word class been omitted.

Polling results turned more positive when queried on the effectiveness of the provided tools for the lesson plan. All indicated agreement with one strongly agrees being lodged. All participants seemed to be happy with the ease in which they were able to incorporate existing Power Point presentations into Slideboom It was noted by some participants that the original technology tool would have been a stronger tool for the lesson plan.

Respondents were again divided when provided the statement "the module provided a set of skills that I was not familiar with" Two respondents disagreed upon the principle that they had utilized educational technology tools before. One respondent agreed with the statement and two indicated that they were unsure. While not using this particular set of provided tools or technology tools in the educational realm they may use technology tools in different applications. Additional information should be collected in this area in the future using more specific wording

While all respondents indicated that they wished to incorporate the technology tools used in the module more in future academic endeavors, wording again solicited caution when polled if the tools used in the lesson plan are something that they can incorporate into their classes. Being

prohibited from .incorporating these tools directly into the classroom by the Hawaii State BOE netted four disagree responses and one agree response from the participants.

More flexibility from the participants was observed when posed with the statement “I would be willing to add more lessons like this into my class schedule”. Perhaps viewed in a more hypothetical light, respondents were all in agreement save for one undecided. Three of the participants directed additional interest to the survey tool and actively sought other similar educational technology tools. Overall feedback was positive on the concept of the instructional module, but the ease in the use of the technology tools drew the most favorable response from the participants.

Research Limitations

The research limitations were primarily based upon the depth at which survey results could be collected. The high school teachers who used the module were providing feedback on its effectiveness based upon what they observed. Perception of effectiveness may have been biased upon a given teachers personal values and aptitude. Some teachers may not have been comfortable using educational technology tools and others may have been overly enthused to try something different. A three tier feedback approach may have been more ideal, where the perception of the students was surveyed and perhaps even outsiders who might review the shared slide show. Due to the focus of the research, only a limited number of subjects could participate restricting the objectivity of the research. Further limitations were encountered when the original technology tool shut down after implementation of the instructional module. An alternate technology tool had to be selected and implemented without delay. This may have factored into three of the original participants declining further involvement in the study citing additional time constraints as preclusive to additional participation.

Research Implications

As educational technology tools continue to find their way into the secondary education classes of today, there are notable disparities in the number of these tools engaged in the math and science classrooms. The reason for this relative absence could be one of several factors, including, lack of suitable tools for these specialized learning environments, reluctance to employ these tools based on fear of negative consequences or general lack of knowledge about existing educational tools. It should be noted, that science labs, generally, suffer no lack of physical technology tools, students are commonly introduced to modern advances in science through the use of technology tools. This in itself may be the issue, as the hands on science lab may discourage the utilization of other educational technologies. Introducing educational technology tools into the science classroom using the proper venue may be the answer to further opening this door.

Once indoctrinated and possessing a new spectrum of educational technology tools, science teachers may realize a more effective and efficient method of instruction. Added flexibility could be achieved allowing teachers the luxury of added time to attend to other problems and priorities.

An example of this would be a posted Slideboom presentation of previous occurrences of an upcoming lab. Students would be able to view the presentation and understand the expectations of the lab. The instructor would have the luxury of adding audio instruction to the images and dubbing good and bad technique segments for student understanding. Another application could be in the form of field trip archives. Each year could be contrasted to previous years and when the budget precludes the field trip, students will still be able to experience it vicariously through the eye of the slide show.

Overall, response from the participating science teachers indicated a very positive experience in supplementing their traditional classroom practices with the educational technology tools of this module. Not only did they generally agree that the content was valuable, several inquired into other technology tools that might be of value in supporting other classroom instructional endeavors. By addressing DOE requirements in the future, teachers and instructional designers may be able to provide a product that is more collaborative and effective within state classroom protocol. The use of non-approved educational technology tools is acceptable off campus. With the state of Hawaii addressing its current economic dilemma by cutting instruction days, educational tools available to the instructor and student off campus may provide the ability to compensate for some of the lost instructional opportunities.

References:

Clarke, I., Flaherty, T.B., Mottner, S. (2001) Student perceptions of educational technology tools. Journal of Marketing Education. 23, 3.

Davidson, K. Hamnet, M and Minato, C. (2005) Economic value of Hawaii's near shore reefs. Social Science Research Institution. Hawaii Coral Reef Initiative Research Program, 1 14-25.

Dexter, S., Anderson, R.E., Becker, H.J. (1999). Teachers' views of computers as catalysts for change in their teaching practice. Journal of Research on Computing in Education, 31, 3,221-239.

ORO, A. (2009) My trip through education with technology. Retrieved February 26, 2010 from NJ tech teacher musings: http://www.njtechteacher.blogspot,com/2009/slideshare-for-classroom-wiki.html

Krentler, K.A., Willis-Flurry, L.A. (2005). Does technology enhance actual student learning? The case of online discussion boards. The Journal of Education for Business. 80, 6, 316-321

National Science Teachers Association. (1999). NSTA Position Statement: The use of computers in science education. Retrieved December 10, 2009, from http://www.nsta.org/159&psid=4

Tabbers, M.K.. Martens, R.L., VanMerrienboer, J.J. (2004) Multimedia instruction and cognitive load theory: Effects of modality and cueing. British Journal of Educational Psychology. 74, 71-81

Tissot, B.N. (2009). The Hawaiian reef ecosystem. Retrieved September 10, 2009 from Hawaii Coral Reef Network http://www.coralreefnetwork.com/reefs/ecology/ecology.htm

Wikipedia contributors. ADDIE Model. (2010) In Wikipedia, The Free Encyclopedia. Retrieved March 21, 2010, from Wikipedia http://en.wikipedia.org/w/index.php?title=ADDIE_Model&oldid=347697081